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Hawai'i Cyclonic Eddies and Blue Marlin Catch Patterns[1]

Michael P. Seki, Rick Lumpkin and Pierre Flament

This research describes a case study in which results of the 1995 annual Hawaiian International Billfish Tournament (HIBT) are examined with respect to prevailing oceanographic conditions. In particular, we consider the presence and role of counterclockwise rotating vortices, or cyclonic eddies, that spin up on time scales of 50–70 days in response to a combination of the Hawaiian Islands' topography and the prevailing northeasterly tradewinds in the lee of the islands. These mesoscale (~10^2 km) features are nowhere more conspicuous or frequent than in the Alenuihaha Channel between Maui and the Big Island of Hawai'i. Cyclonic eddies in subtropical waters, such as those around Hawai'i, vertically displace the underlying nutricline into the overlying, nutrient-depleted euphotic zone, creating localized, biologically enhanced patches.

By examining the HIBT fish-catch data with concurrent oceanographic information mapping the fishing grounds, we offer insights into how these dynamic features may influence pelagic fish distribution. A cyclonic eddy dominated ocean conditions during the weeklong 1995 HIBT, and the resulting distribution of fish catch differed significantly from the tournament's average historical catch patterns. Within the tournament fishing area, well-mixed surface layers and strong current flows induced by the eddy's presence characterized inshore waters, where the highest catches of the prized Pacific blue marlin (Makaira mazara) occurred. This suggests possible direct (e.g., physiological limitations) or indirect (e.g., prey availability) biological responses of blue marlin to the prevailing environment.

[1]"Hawaii cyclonic eddies and blue marlin catch patterns" is adapted from the original article that appeared in the Journal of Oceanography, 58(5):739-745, 2002.

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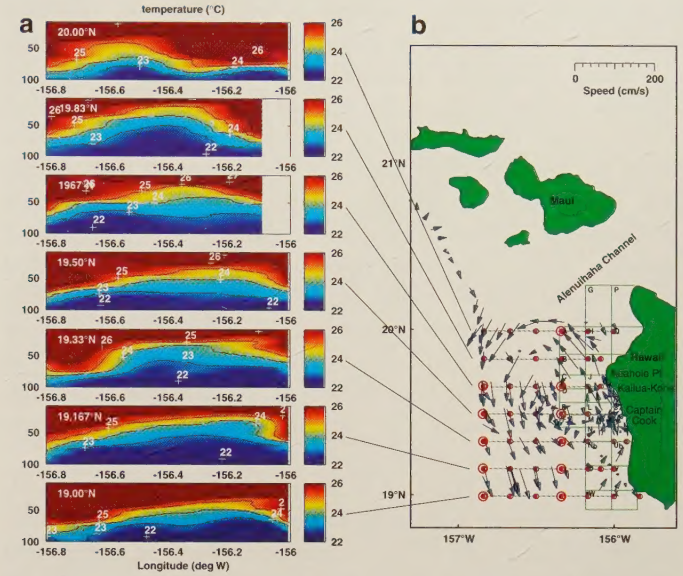

Figure 1. (a) Temperature sections with respect to depth for seven zonal sampling lines aboard the *Townsend Cromwell*, July 26–August 5, 1995. (b) Oceanographic station sampling grid (filled red dots); WOCE drifter deployment positions (red circles) and schematic vector representation of estimated current velocities and direction along the TC cruise track. Current vectors have length scales to reflect relative velocities current speeds and direction averaged over the upper 21-100 m. Green gridlines correspond to statistical areas for the HIBT.

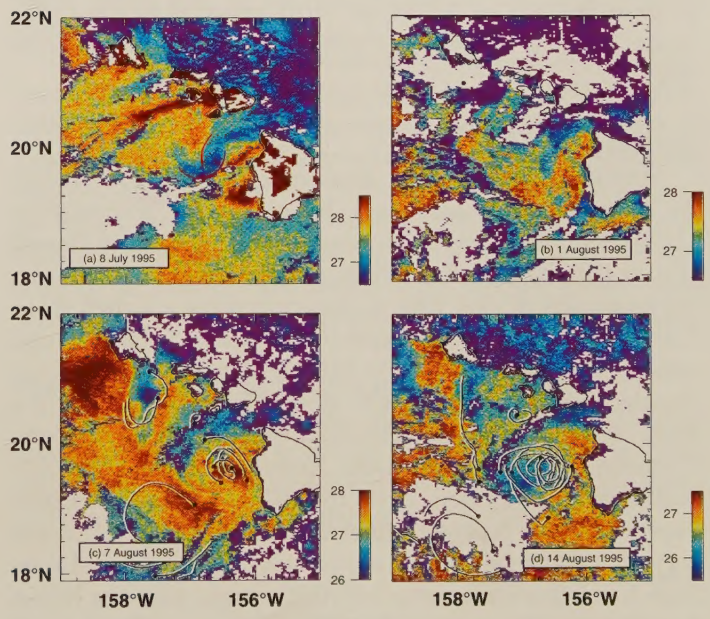

Figure 2. AVHRR SST images (°C) for (a) July 8; (b) August 1– tournament week; (c) August 7; and D) August 14. Concurrent drifter positions (points, with lines showing previous five days) are overlaid SST in (c) and (d). Temperatures colder than 22°C have been flagged as clouds (white).

A Mesoscale Eddy off the Big Island

Ocean activity has long been recognized to play a key role in the distribution, migration, availability and catchability of large pelagic fish such as marlin (Olson et al., 1994). Ocean fronts and eddies in particular have been shown to attract and sustain these large, rapidly swimming animals (Owen 1981). In Hawaiian waters, the combination of prevailing northeasterly tradewinds and island topography encourages the formation of vigorous eddies or current swirls on the leeward side of the islands, which in turn creates the potential for productive fishing areas. These eddies are nowhere more conspicuous or frequent than off the west Kona coast of the Big Island, site of the Hawaiian International Billfish Tournament (HIBT) (Patzert, 1969; Lumpkin, 1998). Like other open-ocean eddies, the biological impact of the Hawai'i eddies can be significant, although their open-ocean, wind-driven features contrast dynamically with those of the well-studied cold-core current-generated eddies such as those that spin off the Gulf Stream or the Kuroshio. The latter variety characteristically will trap or isolate an adjacent water mass, retaining its developed floristic composition.

During the 1995 HIBT, an oceanographic survey was conducted off the southwest Kona coast to map prevailing oceanographic features and determine if these conditions influenced tournament billfish catches (and if so, to what degree). Data were collected aboard the NOAA ship Townsend Cromwell (TC) over an area of about 10,300 km^2. The sampled region extended well beyond the limits of the tournament (Fig. 1), but proved critical nevertheless in providing insight into mesoscale (10^2 to 10^3 km) oceanographic processes such as eddies. To evaluate the relationship between the oceanography and billfish catchability, information on current speeds, direction, water temperature and salinity were compared to the daily catch record for the HIBT provided by the Pacific Ocean Research Foundation (PORF). The results are presented here.

Studying the 1995 Eddy

Shipboard oceanographic measurements were made aboard the TC between July 4 and August 1995 over an area of about 93 by 111 km (50 by 60 nmi) off the southwest Kona coast of Hawai'i (Fig. 1). Hydrographic data (pressure, temperature and conductivity) were acquired with 1000-m-deep casts using a SeaBird 9/11+ Conductivity-Temperature-Depth (CTD) system. Local-scale currents were measured with a 153 kHz hull-mounted RDI acoustic Doppler current profiler (ADCP) along the survey track and to a depth of about 350 m, and processed with subroutines from the Common Oceanographic Data Analysis System (CODAS). Additionally, 11 drifters from the World Ocean Circulation Experiment were deployed within the eddy field (Fig. 1). Satellite sea surface temperature (SST) was evaluated using Advanced Very-High Resolution Radiometer (AVHRR) images from the NOAA Polar-Orbiting Environmental Satellites. Drifter specifications and data processing of drifter and satellite remotely sensed SST are detailed in Lumpkin (1998).

Daily catch records for the 1995 HIBT were provided by the PORF to evaluate the relationship between area oceanography and fishing activity. Pacific blue marlin (*Makaira mazara*) catches are presented principally as a proportion of total catch, and though some measure of catch with effort would have been preferred, no information on fishing effort was available; we therefore relied on historical catch information as a guidance to "typical" blue marlin catch and distribution patterns. To examine the null hypothesis that there is no difference between the historical catch patterns and those observed in 1995 with the eddy present, we computed the chi-square statistic (X^2) on an 11x2 contingency table of positive catch cells from the historical and the 1995 data for goodness of fit. Individual statistical areas with expectation values <1 were pooled geographically to limit bias in the chi-square contingency analysis; specifically, these areas included those located farthest offshore (**A** through **F**), close inshore off Captain Cook (**R** and **S**), and southwest offshore (**M**-**N**-**O**) (Fig. 4).

Characteristics of the Eddy

As evidenced in the AVHRR imagery, the eddy formed shortly before July 8 in the immediate lee of Hawai'i. AVHRR imagery from July 6 (not shown) showed an undisturbed warm pool, but by July 8 cold water in the Alenuihaha Channel west of Keahole Point had begun rotating cyclonically (Fig. 2a). Over the next 10 days, the eddy drifted to the southwest but then turned to the east and propagated directly into the west coast of Hawai'i. By the week of the billfish tournament and TC survey, the eddy was asymmetrically centered about 37 km (20 nmi) off Kailua-Kona, occupying a region of about 111 km (60 nmi) in diameter and pressed tightly against the island (Fig. 2b). Interestingly, the cyclonic eddy during this week appeared uncharacteristically in satellite imagery as a warm core feature, and shipboard surface-temperature measurements corroborated the phenomena (see Fig. 5). Because of the eddy's residence in Hawai'i's wind shadow, diurnal warming appeared to have created a thin layer of warm water overlying the entrained parcel of upwelled cooler water, resulting in the warm core surface expression (Fig. 2b, c). Once the eddy propagated back offshore out of the island's wind shadow, the cold core surface expression could once again be observed in satellite images (Fig. 2d).

Through the water column on the tournament grounds, well-defined surface mixed layers and strong current flows at the periphery of the eddy characterized inshore waters surveyed south of Keahole Point (Fig. 1). Vertical shear was steepest in the surface 75 m, resulting in current speeds exceeding 60 cm/sec^{-1} (1.2 knots) in waters closest to shore off Kailua-Kona and Captain Cook (Fig. 1); vertical cross-sections of the north-south (v) component of current velocity from shipboard ADCP with respect to depth are presented for the zonal sections along the latitudes 19°30'N and 19°40'N (Fig. 3). In deeper waters, current speeds in the main eddy flow measured about 40 cm/sec^{-1} (0.78 knots)[2] and diminished

[2]The public domain Common Oceanographic Data Analysis System (CODAS) software package is available at http://ilikai.soest.hawaii.edu/sadcp/.

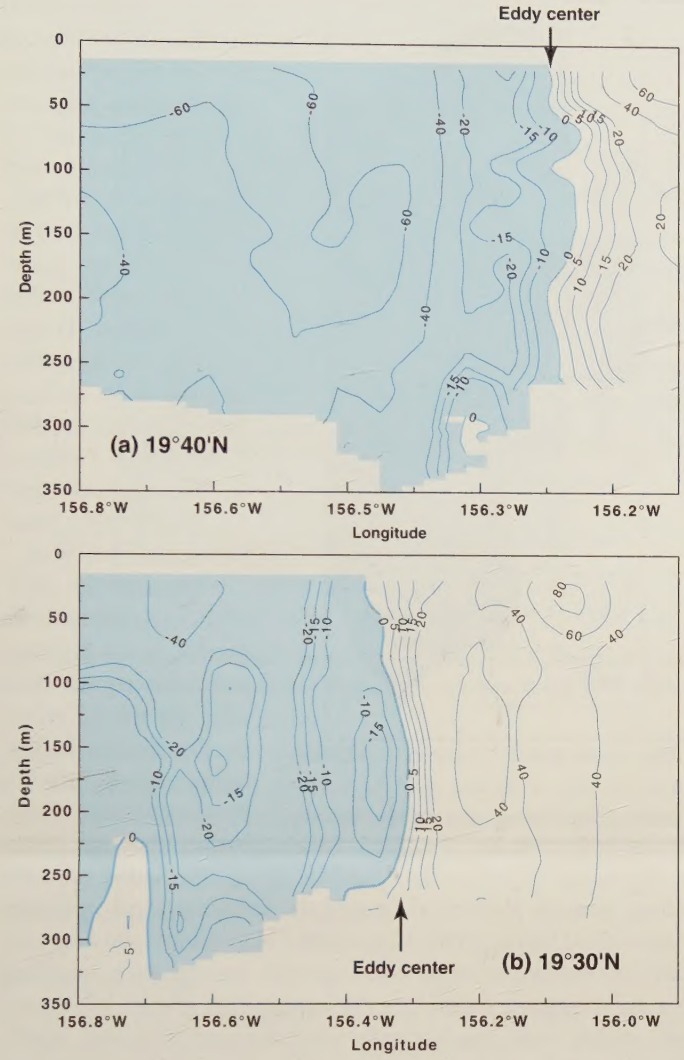

Figure 3. Vertical profiles of depth-averaged estimated north-south components ("v") of current velocities: (a) off Kailua-Kona (i.e., along 19°40'N and between ~156°00'W and 156°50'W, August 3, 1995; and (b) off Captain Cook (i.e., along 19°30'N and between ~156°00'W and 156°50'W, August 2, 1995. White areas represent net northward flow and shaded areas represent net southward flow in, respectively.

rapidly (approaching zero horizontal velocity) towards the eddy center (Figs. 1, 3). At these rates, passively advected particles would complete one revolution around the gyre in about 6.5 days (157 h). Mixed layer depths also extended to a maximum depth of about 75 m, corresponding with the shear profile (Fig. 1). In the absence of wind-generated turbulence, inshore surface mixed layers were thus ascribed directly to the eddy energy and the water mass occupying the tournament area composed largely of recirculated or well-mixed water advected or carried in from offshore.

In contrast, the offshore water column of the eddy interior was well stratified with virtually no evidence of surface mixing (Fig. 1). Characteristic localized fronts formed at the interface of the eddy periphery and core, over a relatively narrow spatial scale of about 2 km (ca. 1 nmi) (Fig. 1, 3). With respect to the fishing grounds, the front was positioned about 18 to 22 km (10 to 12 nmi) offshore.

The 1995 HIBT Catch

Fish catches, including those landed and those tagged and released, were extracted directly from the HIBT daily catch record for the tournament week July 31 to August 4, 1995. Location of fish capture was reported only to a spatial resolution of the HIBT statistical reporting grid (Figs. 1, 4, 5). A total of 89 fish were caught: 80 Pacific blue marlin; 6 yellowfin tuna (*Thunnus albacares*) and 3 striped marlin (*Tetrapturus audax*). For blue marlin specifically, the concentration of catches occurred in statistical area blocks "**S**," where 20.0% were landed, "**L**," with 18.75%, and "**K**," "**T**" and "**U**," each with 13.75% of the total catch (Fig. 4). As mentioned above, no fishing effort data are available to help interpret catch information. For comparative purposes, the proportions of the total historical blue marlin catch for each statistical area from 1959 to 1994 are also presented (Fig. 4).

Although there is probably some interannual variability over the tournament's 36-year history, the catch per area of pooled data provides a good perspective on the general trend of where fish were caught. The chi-square goodness of fit statistic computed for the contingency table compared the historical and 1995 catch patterns by statistical area, and suggested strong evidence for anomalous catch patterns in the 1995 HIBT ($X^2 = 36.59$, df = 10, $p < 0.0005$). For the 1995 tournament, the concentration of catches was centered farther south than normal, and curiously, there was a notable absence of any catch in area "**I**," which historically is the most productive area targeted by experienced anglers. In this case, the absence of catch may reflect reduced effort, but one might expect that annually returning, experienced anglers would expend considerable fishing effort in the area traditionally associated with best catches.[3]

Oceanic eddies of this size are not uncommon in waters adjacent to the west coast of the Big Island (Patzert, 1969; Lumpkin, 1998; Seki et al., 2001). When present, these eddies dominate all other coastal currents, often creating extended periods of strong unidirectional coastwise flow (Robinson and Lobel, 1985). Within the fishing grounds, or the 37 km (20 nmi) closest to shore, the eddy generally appeared as a strong north-northwest current running up the coast towards Keahole Point, where the flow turned offshore to the west, essentially following the island's topography.

Species Response to Environment

Areas of highest blue marlin catches coincided with 1) regions over which the strongest fronts and surface thermohaline gradients were observed (**L** and **K**), and 2) regions of strong coastwise currents and deep surface mixed layers inshore (**S**, **T**, and **U**) (Fig. 5).

(continued on page 4)

[3]Davie, P. S. HIBT catch and fishing effort since 1959. A statistical perspective. 16 pp. Unpublished report available from the Hawaiian International Billfish Association and the Hawai'i Data Center [hdc@aloha.net].

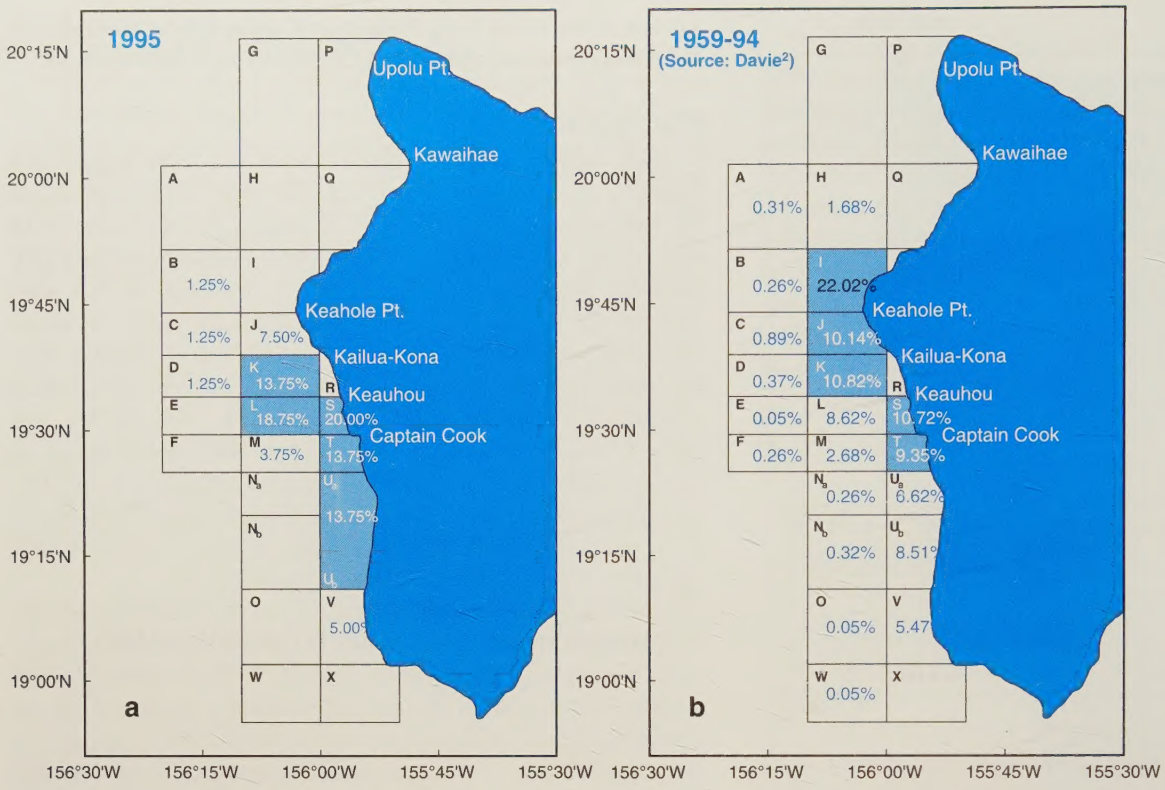

Figure 4. Catch, as proportion of total catch, of Pacific blue marlin (*Makaira mazara*) by fishing area at the Hawaiian International Billfish Tournament for (a) 1995; and (b) 1959–1994 (Davie: see reference in footnote 2).

If catch patterns reflect responses to the environment, some insight into the system underlying development of these patterns may be gained from our existing understanding of blue marlin biology and ecology. For example, acoustic tracking studies conducted off Kona have shown that blue marlin exhibit a marked preference for the warm surface mixed layer above the thermocline, particularly where water temperature varies between 26 and 27°C (78.8– 80.6°F) (Holland et al., 1990; Block et al., 1992). More importantly, while blue marlin are capable of ranging through the thermocline, they apparently rarely do so (Block et al., 1992). This would suggest that, to remain in their preferred habitat, blue marlin migrating into waters south of Keahole Point during the tournament would have been compelled to confine their movements within the narrow swath between the coastline and the front interfacing the stratified eddy interior. With horizontal movement constrained between these bounds (essentially within the peripheral eddy flow), the catchability of the marlin likely increases.

The interplay between ocean conditions and blue marlin foraging may prove an integral link to observed catch patterns. The physical environment may be providing cues for marlin to locate prey even as it aggregates or concentrates food items. Movements and distribution of small tuna, which diet studies have shown to be a particularly favored food among blue marlin (Strasburg, 1970; Brock, 1984), can be strongly influenced by fronts and prevailing ocean conditions (Laurs et al., 1984; Fiedler and Bernard, 1987). Additionally, peculiar to the diet of blue marlin captured in coastal waters off Kona was the prevalence of larval and juvenile reef fish (Brock, 1984). Since these fish may be transported or aggregated by local eddies and currents (Lobel and Robinson, 1986), an eddy field such as that observed in 1995 could create a unique feeding environment that would make these prey readily available.

Attempts to decipher catch patterns with respect to the environment also should consider the role of reproductive strategy in dictating blue marlin movement and distribution. Summer influx of blue marlin onto the fishing grounds appears to be directly tied to seasonal spawning migrations (Hopper, 1990). Conceivably, blue marlin spawning cues may have evolved to target oceanographic features, such as eddies, that are commonly found here during this time of year. When present, eddies could mechanically limit dispersal of young marlin (Owen, 1981; Lobel and Robinson, 1986), thereby helping to retain them within waters favorable to their growth and survival. During the survey, 9 blue marlin larvae[4] were caught in a mere 5 surface plankton tows made within 37 km (20 nmi) of the shore; none were taken in seven tows made 93 km (50 nmi) out.

More Data Required to Resolve Role of Environment in Behavior

In summary, a cyclonic eddy physically occupying some 8500 km^2 of surface area dominated the oceanography off the Kona coast of Hawai'i during the 1995 HIBT. On the tournament grounds, well-mixed surface layers and strong current flows induced by the eddy characterized inshore waters surveyed south of Keahole Point. Offshore, localized fronts formed at the interface of the eddy periphery and core. Areas of high tournament fish catches seemed to coincide with both these eddy-influenced inshore and frontal regions, suggesting possible

[4]Equivocal diagnostic characters keep the larvae identification to blue marlin tentative; IDs courtesy of Bruce C. Mundy.

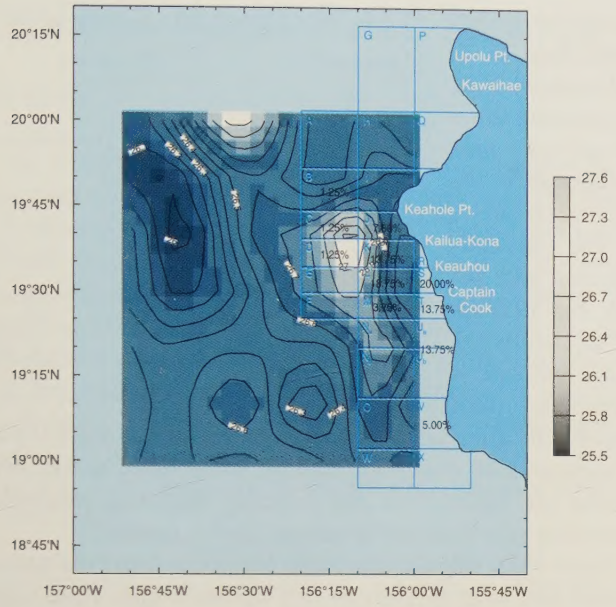

Figure 5. Eddy structure mapped by horizontal sea surface temperature distribution and proportion of total blue marlin catch per area at the 1995 HIBT.

direct (e.g., physiological limitations) or indirect (e.g., prey availability) biological responses of blue marlin to the environment. Unfortunately, lack of information about fishing effort precludes a full investigation of whether these catch patterns are a response to changes in physical environment or simply a chance outcome of effort allocation.

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A FAD of a Different Function

Kim Holland

FADs play a critical role in recreational and commercial fishing by attracting target species to known locations— but this rather simple function may soon be augmented with a new class of FADs that have capabilities especially useful for fisheries researchers and managers. Two projects have been funded for 2003 to investigate the viability and potential of FADs equipped with electronic monitoring devices. The devices presently contemplated are sonar, to track the nearby movement of schools and individual fish, and dedicated receivers, to record the presence and perhaps even the prior activity of tagged fish. One project has been funded by the University of Hawai'i Pelagic Fisheries Research Program, and the other by the European Union.

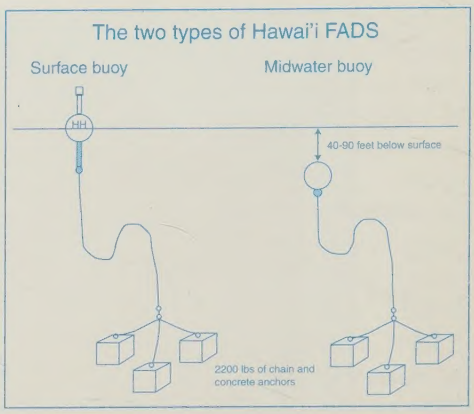
FADs have assumed a tremendously important role in the world's tuna fisheries, but many questions remain regarding the dynamics of FAD-associated tuna aggregations and the biology underlying these aggregations. Sonic tracking studies have provided some insights into the FAD-related behavior of individual fish, but the dynamics that drive the ebb and flow of entire schools of tuna are still largely a mystery. For instance, it is not known if different tuna species use FADs in different ways, or if oceanographic conditions influence the coming and going of schools associated with FADs.

In fact, these tuna/FAD uncertainties are only a subset of a general paucity of knowledge about the entire pelagic ecosystem, from diurnally migrating plankton to tuna, sharks and other species at the top levels of the pelagic food chain. Furthermore, the traditional method of investigating the pelagic realm— using large oceanographic research vessels— is extremely expensive and labor intensive.

Researchers Inspire a New FAD

Against this backdrop, we are proposing the development and deployment of "smart FADS" to serve as autonomous observatories of the pelagic ecosystem. These anchored or drifting buoys would act as platforms for an array of instruments that would monitor the comings and goings of the various pelagic species. The smart FADs would be biological equivalents to the instrumented buoys used for decades by oceanographers to obtain data regarding the physical processes of the oceans. Not only would smart FADs acquire basic data on the pelagic ecosystem in general, but their primary focus on the dynamics of tuna aggregations would immediately improve our ability to wisely harvest this extremely important resource.

The primary tool on smart FADs will be an active sonar system that will monitor a 360 degree "halo" extending laterally several hundred meters around the FAD, from near the surface to approximately 100 meters deep. In its final form, we hope this scanning sonar will not only provide data about the temporal dynamics of the biomass associated with the FAD, but also be able to identify the species and size of individuals that comprise the aggregation. Later, it is intended that the FADs also be equipped with downward-looking sonar tuned specifically to monitor the behavior of the vertically migrating mesopelagic community that is so vital to pelagic trophic systems.



Smart FADs will also carry data loggers to detect the presence of tunas and other species carrying electronic tags. These loggers could detect tags that range in capability from basic sonic pingers that simply say "I'm here" to sophisticated tags that telemeter data concerning the physiological condition of the animal, or relay information to the data logger about the previous movement patterns of a tagged animal. An important subpart of the smart FAD project is to investigate the feasibility of developing new types of electronic tags.

Fortuitous Funding for FADs

The PFRP has decided to fund the development of prototype FADs beginning in 2003; work will be carried out in Hawai'i in close coordination with the State's FAD program. The first step will be to design and develop a 360-degree sonar system and the databases required to accurately identify the various species known to be found around FADs. These identifications will probably be based on a combination of target strength and school behavior data. Development of this sonar system will be the primary responsibility of Dr. Jules Jaffe, a biophysicist with the Scripps Institution of Oceanography, who will work with Project PIs to develop and test the prototype.

Fortunately, the PIs have also received funding from the European Union to develop a similar smart FAD. This project, which will primarily involve European collaborators, leaves the PIs with the enviable task of integrating two well-funded projects that are focused on achieving the same goal, namely: the development of affordable, automated pelagic observatories that could mark a major advance in our understanding and management of pelagic ecosystems.

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PrepCon3 Moves MHLC Forward

John Sibert

The Third Preparatory Conference of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (WCPFC) opened on a positive note with the first participation by Japan in the PrepCon process. The opening statement from that nation cited a number of "fundamental problems" that are obstacles to ratification, but Japan indicated that it has decided to participate for three reasons:

- to help address perceived declines in major stocks;
- to help act decisively against illegal, unregulated and unreported (IUU) fishing; and,
- to help clarify measures for monitoring, control and surveillance (MCS).

Japan presented a paper describing its efforts to document the extent of IUU fishing in large-scale tuna longlining.

Most countries expressed concerns in their opening statements about specific issues. The Forum Fisheries Agency (FFA) countries in particular asserted consistently that the Commission should financially support participation by small island developing states (PINs) in all aspects of Commission activities. This support is envisaged to consist of assistance in human resource development as well as the costs of participating in Commission meetings. In addition, France and New Zealand raised concerns about participation by territories, while FSM announced that it will soon ratify the Convention, and France that it will soon ratify the UNIA. Finally, the PrepCon Chair announced his intention to decide on the site of the WCPFC headquarters.

Much of the work of the PrepCon is conducted by its working groups: WGI, chaired by Lucy Bogari, PNG; WGII, chaired by John Kalish, Australia, and WGIII, chaired by Bill Gibbons-Fly, USA. All working groups made substantial progress at PrepCon3.

WGI: Organizational Structure, Budget and Financial Contributions

WGI considered that, in general, the Secretariat would comprise a staff of about 17 people with an annual budget of slightly more than US$1,300,000. Anticipated costs of scientific and MCS services would push the total commission budget to just under US$2,500,000. However, it was not resolved whether to use the pay scales of the UN or the Council of Regional Organizations of the Pacific.

The FFA countries pushed strongly for the costs of PIN participation to be included in the Commission budget as an assessed (non-voluntary) contribution. Although there seemed to be considerable support for this viewpoint, some Distant-water Fishing Nations were opposed, and the administrative mechanisms required to implement such a fund are not yet fully developed. A draft set of rules and procedures for participation by territories was tabled but not considered in detail because of time constraints.

WGII: Scientific Structure and Provision of Interim Scientific Advice

The deliberations of WGII were surprisingly contentious, but some progress was made. Dr. Yuji Uozumi of Japan was approved as Chair of the Scientific Coordinating Group (SCG), and the date and venue of the second SCG meeting were set for July 17–19, 2003, immediately following SCTB16 in Mooloolaba, Australia. WGII generally endorsed the first report of the SCG, including its assessment of the status of stocks, and the steps that should be taken to reduce uncertainty in assessments. WGII also received the report "Review of data standards, technical capabilities and data sharing policies for the Western and Central Pacific Region," but felt that the report needed revision with respect to whether it dealt only with the interim period or whether it also considered operation of the Commission after the treaty enters into force. The WGII report from PrepCon2, which envisioned a preliminary organizational model, provoked the most discussion. Specific concerns included:

- the closeness of the link between the stock assessment and data management functions;
- provision of alternative stock assessments from member states and fishing entities; and,
- the extent to which science functions should be conducted by existing regional organizations.

These issues were surprisingly contentious, and WGII agreed to work between sessions toward agreement on the Commission's scientific structure.

WGIII: Monitoring, Control and Surveillance

WGIII focused largely on issues surrounding boarding and inspections, such as use of force, intent of inspections, and liability. WGIII requested its Chair, with assistance from the Secretariat and in consultation with interested delegations, to prepare a draft outline of procedures for boarding and inspection. It was agreed that the MCS component of the WCPFC's observer program should be developed in cooperation with the science working group. Japan stressed the importance of the work of WGIII in addressing the problem of IUU fishing in the WCPO.

Home for Headquarters

PrepCon3 devoted one full session and part of a second to resolving the question of the WCPFC headquarters. Six different countries had submitted bids: the FSM, PNG and Tonga before the September 1, 2001 deadline, and Samoa, Fiji and the Philippines after the deadline. By simple majority vote, the Conference rejected the motion by Samoa to waive the deadline, and therefore only FSM, PNG and Tonga were considered. The Chair determined the issue to be a matter of substance requiring a three-fourths majority vote and the use of secret ballots. PNG was eliminated on the

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second round of voting. The voting was deadlocked after 5 rounds, and the matter was deferred until the following morning. On the seventh round, the FSM was selected as the site of the Commission headquarters by a vote of 19 to 6.

Special Fund for PINs

Article 30 of the Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean recognizes the special requirements of developing states, and FFA members presented a proposal to address these requirements. The proposal called for a "Special Requirement Fund" of US$300,000 to cover the costs of travel and development of national expertise within PINs. FFA members were consistent on this issue throughout PrepCon3, and the issue certainly will be raised again at PrepCon4. Reaction from fishing nations was mixed; though many were supportive, it is unclear how this fund can be funded without raising issues of development assistance.

Controlling IUU

Delegates to PrepCon3 supported a resolution on IUU fishing and the growth of tuna fishing effort that:

- urged all states and other concerned entities to take measures promptly to limit expansion of tuna fishing effort in the region and to apply the precautionary approach forthwith;
- urged all States and other concerned entities to take every appropriate measure, in conformity with applicable IPOAs[1] and other relevant international instruments, to prevent, deter and eliminate IUU tuna fishing in the Convention Area;
- decided to exchange information on the activities of fishing vessels that might jeopardize the effectiveness of the resolution, including IUU tuna fishing vessels; and,
- agreed to disseminate this resolution widely.

Conclusions

PrepCon3 was definitely a working session, enjoying progress on most outstanding issues. It appears that the cooperative attitude established during PrepCon2 in Madang was continued in Manila and transformed into a determination to establish a functioning Commission. Deciding on the location of the Commission headquarters cleared the agenda for future sessions, and further progress is expected in 2003. The return of Japan to the process, and the generally constructive attitude of the Japanese delegates, are very encouraging. However, the effectiveness of the Commission in conserving stocks will depend on the willingness of participants to adequately finance Commission activities.

All of the PrepCon working papers and reports can be obtained from the WCPFC web site, at http://www.ocean-affairs.com/DocListing.html

PrepCon4 will be held in May 2003, and though the site was not confirmed, reliable scuttlebutt indicated New Caledonia. PrepCon5 will be held in late September or October in the Cook Islands.

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[1]International Plan of Action. The Food and Agricultural Organization of the United Nations has established an IPOA on IUU fishing; see http://www.fao.org/DOCREP/003/y1224e/y1224e00.HTM.

Compendium—Fisheries Research in Brief

CITES Goes Commercial

In November, the 160 signatories to the Convention on International Trade in Endangered Species (CITES) agreed to broaden the organization's active monitoring to include whale and basking sharks, as well as trade in several "commercial" species of plants and animals such as seahorses.

Until the just-concluded conference in Santiago Chile, CITES focused mainly on trade in rare plants and animals, offering little attention to species that are economically significant. CITES' deputy secretary general Jim Armstrong said the broadening of coverage is "quite a watershed" in the organization's attitude toward conservation. While timber and fisheries traditionally have been regulated by national governments and bodies such as the United Nations' FAO, CITES now will contribute its assessments to efforts to control large-scale species exploitation.

In a potential harbinger for marine life, all 32 species of seahorse, prized for aquariums and traditional medicines, were listed on Appendix II. The listing requires each exporting state to ensure that all exports are sustainable and covered by CITES permits; the main exporters are Indonesia, the Philippines and Brazil.

"It's a tremendous outcome," says Callum Roberts, a conservation biologist at the University of York, UK, who noted that conservationists worked with traders to convince them that regulation would protect their livelihoods, rather than destroy them. The next CITES conference will be in Thailand in late 2004 or early 2005. *(adapted from Nature News Service, © Macmillan Magazines Ltd., 19 November 2002)*

You Lie like a Dog(fish)

Of course, a more academic headline would be "Bias Inherent in Fishermen's Reports," but there it is nonetheless: recent research reveals that the worse catch an angler has, the more he or she tends to "exaggerate" success in surveys.

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The implication for fisheries management? "Exaggeration creates the appearance that a fishery isn't declining as fast as it really is, then all of a sudden there's a collapse," says principal researcher Michael Sullivan, of the Alberta Fish and Wildlife Service; Sullivan goes so far as to advocate emergency action as soon as reports show any hint of decline.

A less drastic response, explained by ecologist John Post, of the University of Calgary, would be to develop a reliable statistical predictor of this "fishermen's fib factor," and incorporate it into mathematical models used to monitor stocks and set catches.

That may be a tall order. "As an angler, I know that there's a tendency to promote your prowess," says Sullivan. "You don't want to admit that your neighbor caught a fish and you didn't. Now I've measured that tendency, and it's huge."

(adapted from Nature News Service, © Macmillan Magazines Ltd., 20 November 2002. For details, see: Sullivan, M. Exaggeration of walleye catches by Alberta anglers. North American Journal of Fisheries Management, in press, 2002.)

Climate as Population Driver

A 2,200-year record of Alaskan salmon populations has revealed centuries-long fluctuations in stock numbers, with the biggest, quickest changes seeming to mirror climate shifts seen around western North America. The record shows salmon populations were scarce between 100 BC and 800 AD, then grew until around 1200 and stayed high until about 1900, when commercial fishing began to take its toll.

Project biologist Irene Gregory-Eaves, of Queen's University in Ontario, Canada, says the long lean period was worse than any decline or perceived shortage seen in the modern era. "Salmon populations can be very depressed for hundreds of years, and then ramp up for hundreds of years." The gyrations are influenced by climate through its effect on the migrating fish's staple food: plankton. Low pressure far out in the North Pacific reduces mixing of coastal waters, keeping plankton in the sunlit upper ocean and boosting its abundance, and therefore that of the salmon.

The salmon record confirms that climate alone can induce massive changes in species populations. But the record's significance also lies in the fact that, as one strand in the web of connections that bind climate to life on a global scale, the record may be representative or indicative of the condition of concurrent species. "These patterns affect many species at once," says oceanographer John Dower of the University of Victoria, Canada. "There are really big ecosystem-level links."

(adapted from Nature News Service, © Macmillan Magazines Ltd., 18 April 2002. For details, see: Finney, B.P., Gregory-Eaves, I., Douglas, M.S.V. & Smol, J.P. Fisheries productivity in the northeastern Pacific Ocean over the past 2,200 years. Nature, 416, 729–733. For another perspective on short- and long-term variations in species population, see Ravier and Fromentin's "Trends in NE Atlantic and Meditteranean Bluefin Abundance," in PFRP volume 6, number 4.)

Upcoming Events

54th IATTC/NMFS Tuna Conference

May 13–16, 2003

Back to Basics in Pelagic Fisheries Research

The 54th Tuna Conference sponsored by the IATTC and NMFS will be held at the University of California's Lake Arrowhead Conference Center. Presentations are welcome on any subject, but participants are encouraged to share research on topics such as new technologies for reducing uncertainty in biological parameters, fishery data collection, fleet behavior and dynamics, and incorporating single-species uncertainty into ecosystem-level analyses. Abstracts must be received by March 28, 2003. For more information, contact conference chair Shelton Harley at (858) 546-7022, Fax (858) 546-7133, e-mail tunaconf@iattc.org. Or visit the Tuna Conference's home page at http://swfsc.ucsd.edu/tunaconf.html.

IATTC and AIDCP Meetings

- February 3, 2003
  Working Group on Vessel Assessment and Financing, La Jolla, California
- February 4, 2003
  Working Group to promote and publicize the AIDCP dolphin safe tuna certification system, La Jolla
- February 5, 2003
  12th Meeting of the Permanent Working Group on Tuna Tracking, La Jolla
- February 6–7, 2003
  32nd Meeting of the International Review Panel, La Jolla
- March 18–23, 2003
  10th Meeting of the Working Group on the IATTC Convention, La Jolla
- May 19–21, 2003
  Meeting of the Working Group on Stock Assessment, La Jolla, California
- June 17–28, 2003
  IATTC/AIDCP Meetings, Antigua, Guatemala

For more information, go to http://www.iattc.org/MeetingsENG.htm.

Western Pacific Regional Fisheries Management Council Meetings

- January 28–30, 2003: *82nd SSC Meeting,* in WPRFMC Offices, Honolulu, Hawai'i USA
- February 10–14, 2003: *117th Council Meeting,* in the Commonwealth of the Northern Marianas (Dates are tentative; for details, go to http://www.wpcouncil.org/events.htm)

PFRP researchers and guests gathered in Honolulu in December to discuss the findings and status of projects at the annual principal investigators' meeting. Look for a review of the meeting in the next issue of this newsletter in April.

PFRP Pelagic Fisheries Research Program

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